Level 2 NVQ Diploma in Performing Engineering Operations (7682)

C&G Unit No: 205

QCF Credit Value: 14

Unit Title: Producing components using hand fitting techniques

Candidate	
Candidate No	

Table of Contents

Unit Assessment Plan & Feedback

Candidate		Group	

Unit & Assessment Plan

This unit will be completed by carrying out the practical assessment which must meet criteria, being observed undertaking part of assessment 3 and answering the knowledge questions.

Summative Decision & Candidate Feedback

Assessor Name			
Assessor Signature		Date	

Candidate Name			
Candidate Signature		Date	

Unit Assessment & Verification Declaration

Candidate Declaration: I confirm that the evidence listed for this unit is authentic and a true representation of my own work.			
Candidate Name			
Candidate Signature		Date	

Assessor Declaration: I confirm that this candidate has achieved all the requirements of this unit with the evidence listed. Assessment was conducted under the specified conditions and context, and is valid, authentic, reliable, current and sufficient. **Competence has also been proven in regard to pages 5, 11, 13, 14, 17, 19, 20, 23, observation assessment page 26, 27 and knowledge questions.**			
Assessor Name			
Assessor Signature		Date	

Internal verifier declaration:
I have internally verified the assessment work on this unit by carrying out the following (please tick):

☐ sampling candidate and assessment evidence

☐ observation of assessment practice

☐ discussion with candidate

☐ other – please state:

I confirm that the candidate's sampled work meets the standards specified for this unit and may be presented for external verification and/or certification.

☐ Signed off by Internal Verifier for certification although not sampled

Internal Verifier Name			
Internal Verifier Signature		Date	

Witness Statement

I confirm the candidate on three occasions carried out the required assessments which conform to the requirements of the assessment criteria and in doing so proved competent

1) Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	
2) Adhered to procedures and systems in place	
3) Ensured all cables, leads and air supply were safe and in a serviceable condition	
4) Returned all tools to the correct location	
5) Checked all tools and measurement equipment were in calibration date	
6) Sought additional information where there were gaps or deficiencies	
7) Dealt with or reported problems found	
8) Reported inaccuracies and descrepancies in drawings and specs	

Candidate proved competent see declaration page 4

Awarding Body Standards

Replace this page with the awarding body standards

Evidence Index

		Performance Evidence 1	Performance Evidence 2	Performance Evidence 3	Additional Performance Evidence (if required)
	Evidence Type	***Product/Written***	***Product/Written***	***Product/Written /Observation***	
	Date				
	ASSESSMENT CRITERIA				
1	**Worked safely at all times, complying with health and safety legislation, regulations and other relevant guidelines**	*05*	*5*	*5*	
2	**Carried out all of the following during the assembly activities:**				
	• Adhered to procedures or systems in place for risk assessment, COSHH, personal protective, equipment and other relevant safety regulations	*5*	*5*	*5*	
	• Ensured that all power tool cables, extension leads or air supply hoses were in a safe and serviceable condition	*5*	*5*	*5*	
	• Returned all tools and equipment to the correct locations on completion of the assembly	*5*	*5*	*5*	
	• Checked that tools and measuring instruments to be used were within calibration date	*5*	*5*	*5*	
3	**Planned the assembly activities before they start them**	*11*	*17*	*23*	
4	**Obtained and prepared the tools and equipment and checked they were in serviceable condition.**	*13*	*19*	*25*	
5	**Marked out the components for the required operations, using correct tools and techniques.**	*13*	*19*	*25*	
6	**Marked out a range of material forms to include TWO of the following:**				
	• Square/rectangular	*13*			
	• Circular/cylindrical	*13*		*27*	
	• sections				
	• irregular shapes	*13*	*21*	*27*	
7	**Used marking out methods and techniques, to include:**				
	• direct marking using instruments		*19*	*25*	
	Plus one more of the following:				
	• use of templates		*21*		
	• tracing/transfer				
8	**Used a range of marking out equipment, to include ALL the following:**				
	• rules/tapes	*13*	*19*	*25*	
	• dividers/trammels	*13*	*19*	*25*	
	• scribers	*13*	*19*	*25*	
	• punches	*13*	*19*	*25*	
	• scribing blocks	*13*	*19*	*25*	
	• squares	*13*	*19*	*25*	

	• protractor		*19*	*25*	
	• vernier instruments				
9	**Marked out work pieces which included ALL of the following:**				
	• datum/centre lines		*19*	*25*	
	• square/rectangular profiles	*13*			
	• circles	*13*	*19*		
	• radial profiles	*13*	*19*	*27*	
	• linear hole positions	*13*	*19*		
	Plus one more from:				
	• angles/angular profiles			*27*	
	• radial hole positions		*20*	*27*	
	• allowances for bending				
	• simple pattern development				
10	**Cut and shaped the material to the required specification, using appropriate tools and techniques**	*13*	*20*	*25*	
11	**Cut and shaped two different types of material from:**				
	• low carbon/mild steel	*13*	*19*		
	• high carbon steel				
	• cast iron				
	• stainless steel				
	• aluminum/aluminum alloys			*28*	
	• brass/brass alloys				
	• plastic/nylon/synthetic				
	• composite				
	• other specific material				
12	**Used a range of hand fitting methods, to include ALL:**				
	• filing	*13*	*19*	*25*	
	• hand sawing	*13*	*19*	*25*	
	• drilling	*13*	*19*	*25*	
	• external threads			*25*	
	• internal threads				
	Plus one more from:				
	• power sawing			*25*	
	• off hand grinding				
	• scraping				
	• chiseling				
	• lapping		*19*		
13	**Produce components which combine different operations and have features that cover all of the following:**				
	• flat datum faces		*19*		
	• faces square to each other				
	• curved profiles	*13*	*19*		
	• drilled through holes	*13*	*19*		
	• reamed holes	*13*			
	• internal threads		*19*		
	• external threads			*27*	
	Plus three more of the following:				

	• faces parallel to each other				
	• faces angled to each other				
	• holes drilled to a depth				
	• chamfers and radii	*13*			
	• counterbore, countersink or spot face	*13*			
	• sliding or mating parts			*28*	
14	**Measured and checked all dimensional and geometric aspects were to specification**	*14*	*20*	*27*	
15	**Used all of the following measuring equipment:**				
	• external micrometers		*19*		
	• vernier caliper	*13*		*25*	
	• surface finish equipment	*13*	*19*	*25*	
	Plus four more of the following:				
	• rules	*13*	*19*		
	• squares	*13*	*19*		
	• calipers				
	• protractors	*13*	*19*		
	• depth micrometer				
	• depth vernier				
	• feeler gauges				
	• bore/hole gauges				
	• slip gauges				
	• radius/profile gauges		*19*		
	• thread gauges	*13*		*25*	
	• dial test indicator				
16	**Carried out checks for accuracy including ALL of:**				
	• linear dimensions	*14*	*20*	*27*	
	• flatness	*14*	*20*	*27*	
	• squareness	*14*	*20*	*27*	
	• angles	*14*		*27*	
	• profiles	*14*		*27*	
	• hole position		*20*	*27*	
	• hole size/fit	*14*	*20*	*27*	
	• depths	*14*	*20*	*27*	
	• thread size/fit		*20*	*27*	
	• surface finish	*14*	*20*	*27*	
17	**Produced components to all the following standards:**				
	• components were free from false cuts, burrs and sharp edges	*14*	*20*	*27*	
	• dimensions within tolerance +/- 0.25mm or +/- 0.010”	*14*	*20*	*27*	
	• one or more specific tolerances within +/- 0.1mm or +/-0.004”	*14*	*20*	*27*	
	• flat and square to 0.05mm per 25mm or 0.002 per in	*14*	*20*	*27*	
	• angles within +/- 1 degree	*14*	*20*	*27*	
	• threads to BS medium fit	*14*	*20*	*27*	
	• reamed and bored holes within H8	*14*	*20*	*27*	
	• surface finish 63 µin or 1.6 µm	*14*	*20*	*27*	
18	**Dealt promptly and effectively with problems or sought advice with problems outside own control**	*13*	*19*	*25*	
19	**Left work area clean and tidy**	*13*		*25*	

Assessment 1

Assessment 1 brief :

Manufacture a **Drill Angle Gauge** using hand fitting techniques to meet the required standard which is set out in the unit documentation. You will need to plan for the required activities whilst ensuring all the H&S aspects are met to the necessary standards. On completion you will be required to complete the inspection record and complete the required portfolio references in readiness for assessment.

Assessment pack 1 contents:

- Planning & Operation Sheet
- Copy of Risk Assessment
- Assessor Checklist
- Inspection Record & Feedback
- Assessment 1 Drawing

PLANNING & OPERATION SHEET - ASSESSMENT 1			
Name		**Date**	
Tools Required			**Materials Required**

WRITE DOWN HOW YOU CARRY OUT THE TASK AND THE ORDER EACH STEP WILL BE TAKEN			
1		**14**	
2		**15**	
3		**16**	
4		**17**	
5		**18**	
6		**19**	
7		**20**	
8		**21**	
9		**22**	
10		**23**	
11		**24**	
12		**25**	
13		**26**	

3 What's Risk Assessment

Insert here

Unit 205 - Producing components using hand fitting techniques

Assessor Checklist for Assessment 1	
Obtained and prepared the tools and equipment and ensured they were serviceable	
Marked out using correct tools, techniques and operations	
Used instruments for direct marking	
Used the following range of equipment – rules, tapes, dividers, scribers, punches, scribing blocks, squares, protractor, vernier	
Marking out included – circles, radial profile, linear hole position, angles.	
Cut and shaped to specification	
Used low carbon steel	
Used a range of methods – filing, hand sawing, drilling	
Component combines – curved profile, drilled through holes, reamed holes, chamfer, radii and countersink.	
Used the following measuring equipment – vernier calliper, surface finish, rule, square, protractor, radius gauge.	
Dealt with problems during progression	
Returned tools, left area clean and safe	

Candidate has met above criteria, see declaration page 4

Unit 205 - Producing components using hand fitting techniques
ASSESSMENT 1 INSPECTION SHEET

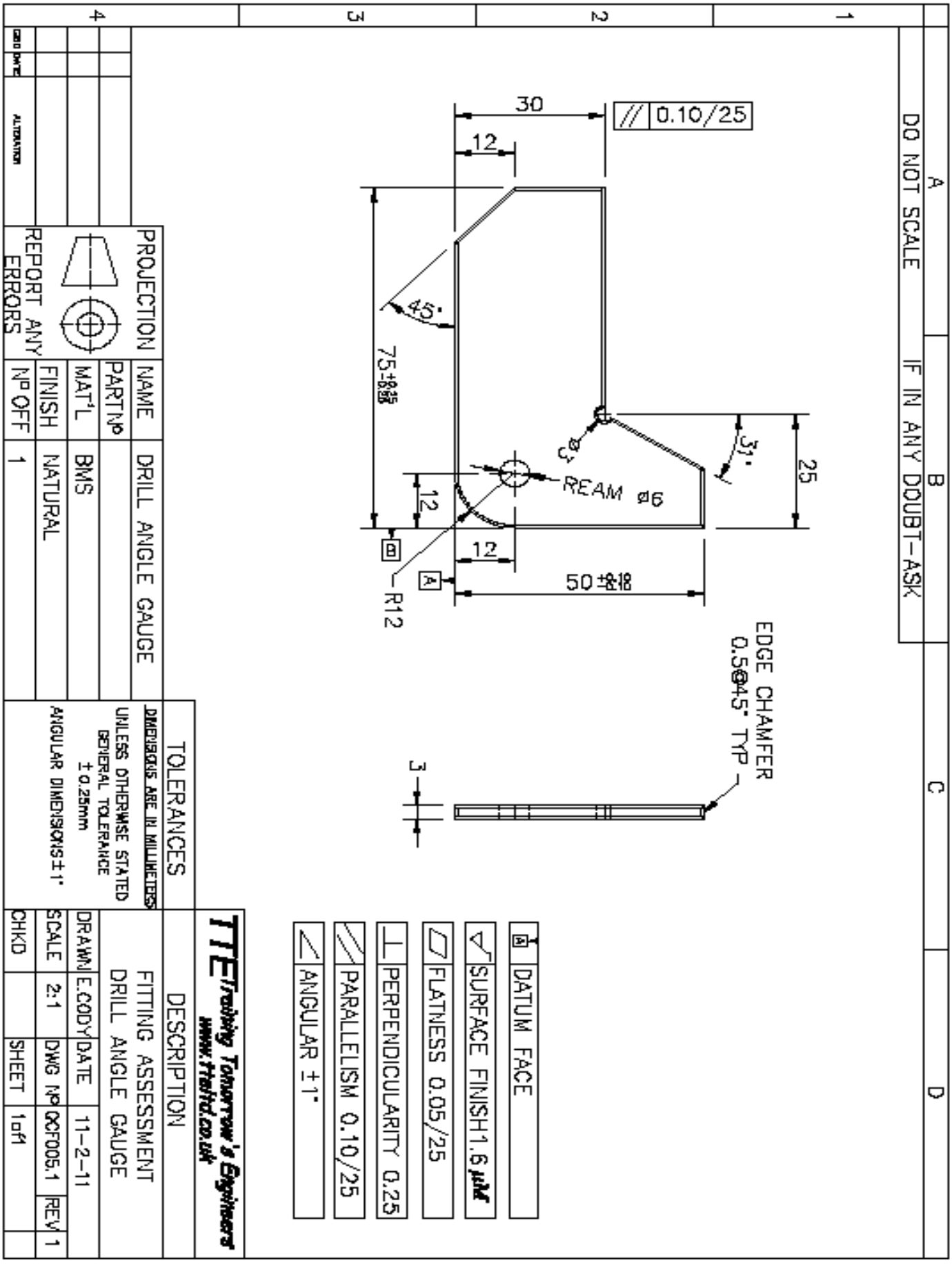
Checked Drawing Dimension	Candidate Checked	Does product meet criteria?
50mm Upper Horizontal (+/- 0.10mm)*		
30mm Lower Horizontal		
Ø6 mm Hole position 12mm V 12mm H		
Ø3 mm Hole position 30mm V 25mm H		
Ø6 mm Reamed Hole to H8		
Overall Length 75mm		
Profile Radius 12mm		
31˚ Angled Face		
45˚ Angled Face		
Assessment Criteria		
Components free from tool cuts, Burrs & sharp edges		
General dimensional tolerance +/- 0.25mm		
* Specific dimensional tolerance +/- 0.10mm		
Flat / Square Tolerance 0.10mm per 25mm		
Angles within +/- 1 degree		
Reamed and bore holes within H8/Produced threads to BS medium fit		
Surface Finish 1.6um Ra		
Assessor Feedback		
Candidate Feedback		

Candidate	Signed	Date

Candidate has proved competent see declaration page 4

Unit 205 - Producing components using hand fitting techniques

Assessment 1 Drawing



Assessment 2

Assessment 2 brief :

Manufacture a **End Cover Plate** using hand fitting techniques to meet the required standard which is set out in the unit documentation. You will need to plan for the required activities whilst ensuring all the H&S aspects are met to the necessary standards. On completion you will be required to complete the inspection record and complete the required portfolio references in readiness for assessment.

Assessment pack 2 contents:

- Planning & Operation Sheet
- Copy of Risk Assessment
- Assessor Checklist
- Inspection Record & Feedback
- Assessment 2 Drawing

PLANNING & OPERATION SHEET - ASSESSMENT 2			
Name		**Date**	
Tools Required			**Materials Required**

WRITE DOWN HOW YOU CARRY OUT THE TASK AND THE ORDER EACH STEP WILL BE TAKEN			
1		**14**	
2		**15**	
3		**16**	
4		**17**	
5		**18**	
6		**19**	
7		**20**	
8		**21**	
9		**22**	
10		**23**	
11		**24**	
12		**25**	
13		**26**	

3 What's Risk Assessment

Insert here

Unit 205 - Producing components using hand fitting techniques

Assessor Checklist for Assessment 2	
Obtained and prepared the tools and equipment and ensured it was serviceable	
Marked out using correct tools, techniques and operations	
Used instruments for direct marking	
Used the following range of equipment – rules, tapes, dividers, scribers, punches, scribing blocks, squares, protractor, vernier	
Marking out included – datum/centre line, radial holes, linear hole positions, radial hole positions.	
Cut and shaped to specification	
Used low carbon steel	
Used a range of methods – filing, hand sawing, drilling, lapping.	
Component combines – flat datum face, curved profile, drilled through holes, internal threads, chamfers.	
Used the following measuring equipment – external micrometer, vernier calliper, surface finish, rule, square, protractor, radius gauge.	
Dealt with problems during progression	
Returned tools, left area clean and safe	

Candidate met above criteria, see declaration page 4.

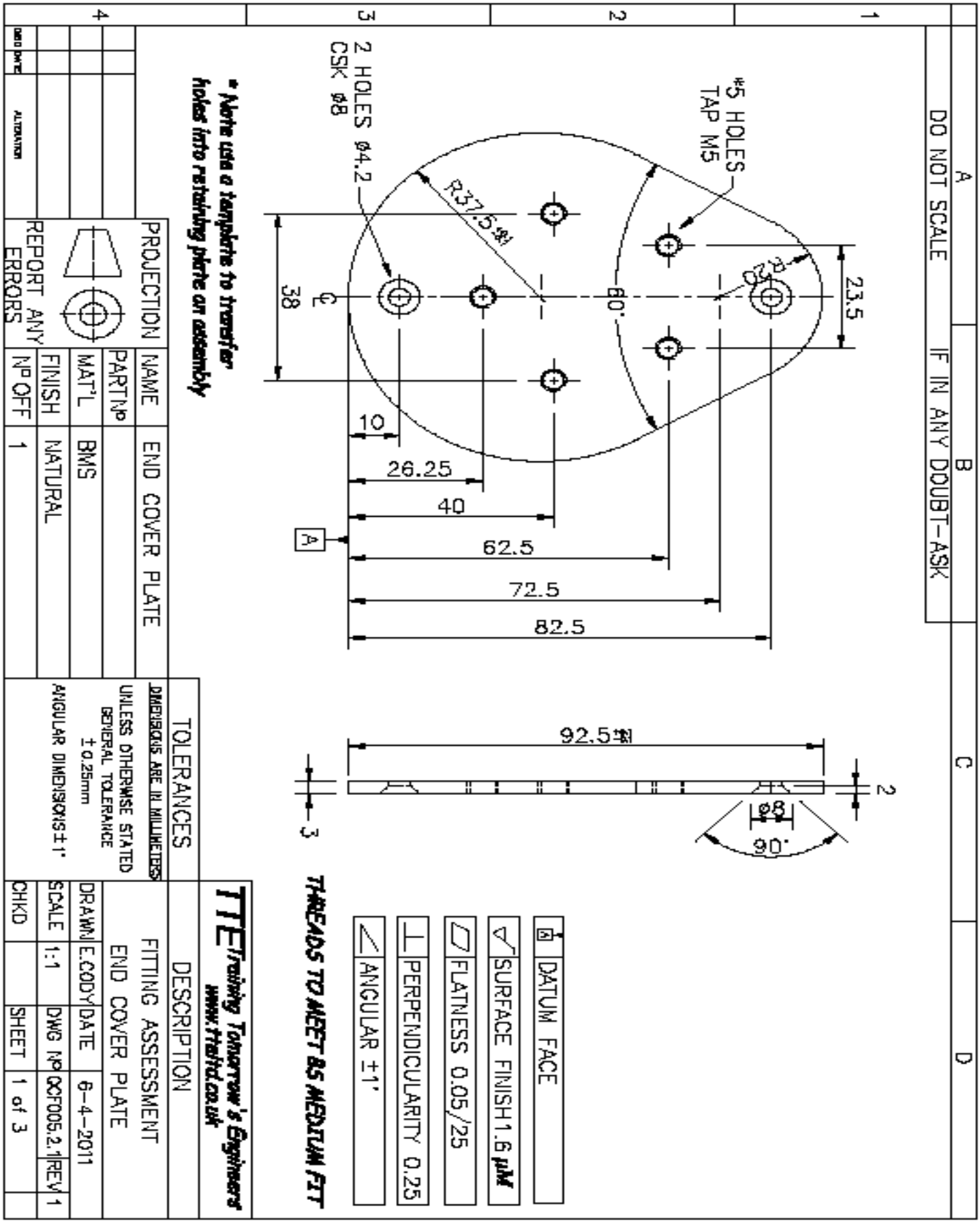
Assessment 2 – Inspection Sheet

Checked Drawing Dimension	Candidate Checked	Does product meet criteria
92.5mm Height (+/- 0.10mm)*		
75mm Width (Radius 37.5 +/- 0.10mm)*		
Profile Radius 20mm		
Ø4 CSK Hole Position Y axis 10mm		
Ø4 CSK Hole Position Y axis 82.5mm		
Ø4 mm CSK Hole Spec		
M5 Hole Position Y axis 26.25mm		
M5 Hole Position Y axis 40mm		
M5 Hole Position X axis 38mm Ctr's		
M5 Hole Position Y axis 62.5mm		
M5 Hole Position X axis 23.5mm Ctr's		
60˚ Angled Faces		
Assessment Criteria 17 - Standards		
Components free from tool cuts, Burrs & sharp edges		
General dimensional tolerance +/- 0.25mm		
* Specific dimensional tolerance +/- 0.10mm		
Flat / Square Tolerance 0.10mm per 25mm		
Angles within +/- 1 degree		
Screw threads to BS Medium fit		
Reamed and bore holes within H8		
Surface Finish 1.6um Ra		
Assessor Feedback		
Candidate Feedback		

Candidate	Signed	Date

Candidate proved competent see page 4

Assessment Drawing 2



Assessment 3

Assessment 3 brief :

Using hand fitting techniques manufacture a **Pentagonal Retaining Plate & M-5 Studs** – which is part of an assembly with Assessment 2.

You will need to use assessment 2 as a template to transfer the hole positions into the pentagonal plate to ensure alignment for assembly. You will need to plan for the required activities whilst ensuring all the H&S aspects are met to the necessary standards.

On completion you will be required to complete the inspection record and complete the required portfolio references in readiness for assessment.

Assessment pack 3 contents:

- Planning & Operation Sheet
- Copy of Risk Assessment
- Assessor Observation Checklist
- Inspection Record & Feedback
- Assessment 3 Drawing
- Assessment 3 Assembly Drawing

PLANNING & OPERATION SHEET - ASSESSMENT 3			
Name		**Date**	
Tools Required			**Materials Required**

WRITE DOWN HOW YOU CARRY OUT THE TASK AND THE ORDER EACH STEP WILL BE TAKEN			
1		**14**	
2		**15**	
3		**16**	
4		**17**	
5		**18**	
6		**19**	
7		**20**	
8		**21**	
9		**22**	
10		**23**	
11		**24**	
12		**25**	
13		**26**	

3 What's Risk Assessment

Insert here

Unit 205 - Producing components using hand fitting techniques

Observation Assessment	Assessor Sign
Obtained all required documentation checked for validity and errors	
Completed Risk Assessment and selected appropriate PPE	
Collected appropriate tools/equipment and checked they were in safe and usable condition	
Checked calibration on Vernier height gauge	
Correctly used power saw to produce billet	
Correctly selected and used marking out equipment and marked out correctly to drawing	
Used files, hand saw, drill, thread and surface finish gauges and produced threads	
Checked dimensions to drawing after marking out	
Correctly used hand tools following safe systems of work to cut and shape the components	
Checked and safely used drilling machine	
Measured and checked component specification with drawing	
Worked safely at all times complying to TTE H&S regulations	
Effectively dealt with problems and sought help and guidance when required	
Checked and correctly replaced tools/equipment leaving the work area in a clean safe tidy condition	
Returned unused materials and safely disposed of any waste	

Knowledge questions asked during performance
1
2
3

4
5
6

I confirm the T.O. explained the principles of the observation assessment to me and I agreed to this observation taking place.	
Candidate:	**Date:**

Candidate proved competent see page 4

Assessment 3 – Inspection sheet

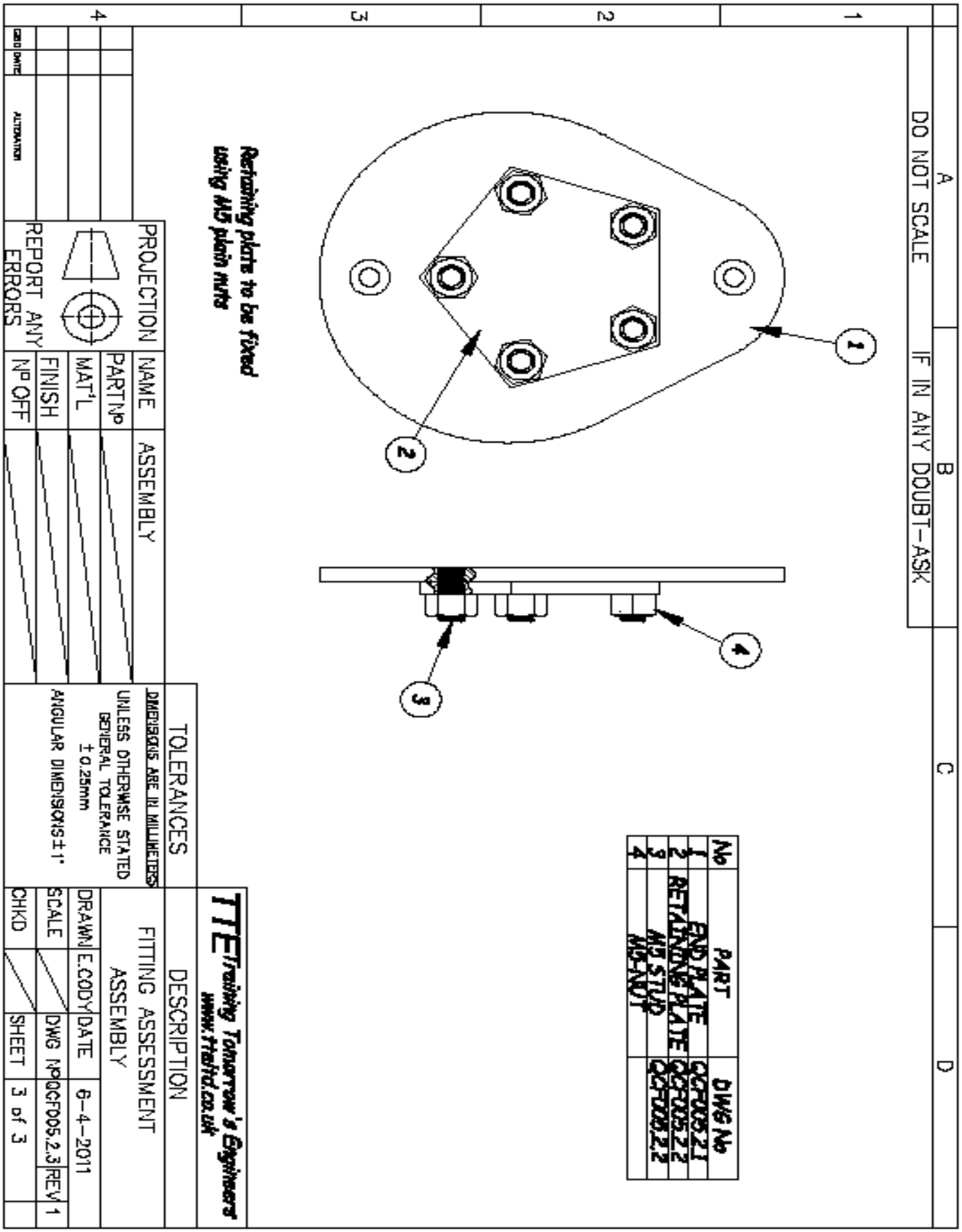
Checked Drawing Dimension	Candidate Checked	Does product meet criteria
Hole positions		
External threads		
Linear dimension		
Profile		
47.5 V (+/- 0.25mm)		
49.9mm H (+/- 0.25mm)		
29.4mm V (+/- 0.25mm)		
30.9mm H (+/- 0.25mm)		
Ø 40mm PCD (+/- 0.25mm)		
Ø 6mm Holes (+/- 0.25mm)		
Stud Length 12 (+0, - 0.5mm)		
Components free from tool cuts, Burrs & sharp edges		
General dimensional tolerance +/- 0.25mm		
* Specific dimensional tolerance +/- 0.1mm		
Flat / Square Tolerance 0.05mm per 25mm		
Angles within +/- 1 degree		
Screw threads to BS Medium fit		
Reamed and bore holes within H8		
Surface Finish 1.6um Ra		
Assessor Feedback		
Candidate Feedback		

Candidate	Signed	Date

Candidate proved competent see page 4

Assessment Drawing 3

Assessment Assembly Drawing 3



Underpinning Knowledge

Candidate	

1)	Describe the health and safety requirements and safe working practices and procedures required for the hand fitting activities undertaken
2)	Describe the importance of wearing appropriate protective clothing and equipment, and of keeping the work area safe and tidy
3)	Describe the hazards associated with the hand fitting activities (such as use of power tools, trailing leads or hoses, damaged or badly maintained tools and equipment, using files with damaged or poor fitting handles), and how they can be minimised

4)	Describe the procedure for obtaining the required drawings, job instructions and other related specifications

5)	Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate bs or iso standards), in relation to work undertaken

6)	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, work piece reference points and system of tolerancing

7)	Explain how to prepare the materials in readiness for the marking out activities, in order to enhance clarity, accuracy and safety (such as visually checking for defects, cleaning the materials, removing burrs and sharp edges, applying a marking out medium)
8)	Explain how to select and establish a suitable datum; the importance of ensuring that marking out is undertaken from the selected datum, and the possible effects of working from a different datum
9)	Describe the methods of holding and supporting the workpiece during the marking out activities, and equipment that can be used (such as surface plates, angle plates, vee blocks and clamps, parallel bars, screw jacks)

Unit 205 - Producing components using hand fitting techniques

10)	Describe the use of marking out conventions when marking out the workpiece (including datum lines, cutting guidelines, square and rectangular profiles, circular and radial profiles, angles, holes which are linearly positioned, boxed and on pitch circles)

11)	Describe the ways of laying out the marking out shapes or patterns to maximise use of materials

12)	Describe the need for clear and dimensional accuracy in marking out to specification and drawing requirements

13)	Explain how to set and adjust tools (such as squares, protractors and verniers)
14)	Describe the importance of using tools only for the purpose intended; the care that is required when using the equipment and tools; the proper way of storing tools and equipment between operations
15)	Describe the cutting and shaping methods to be used, and the sequence in which the operations are to be carried out

16)	Describe the various types of file that are available, and the cut of files for different applications

17)	Describe the importance of ensuring that file handles are secure and free from embedded foreign bodies or splits

18)	Explain how to prepare the components for the filing operations (cleaning, de-burring, marking out)

19)	Describe the use of vice jaw plates to protect the workpiece from damage
20)	Explain how to file flat, square and curved surfaces, and how to achieve a smooth surface finish (such as by draw filing, the use of abrasive cloth, lapping using abrasive pastes)
21)	Explain how to select saw blades for different materials, and how to set the saw blades for different operations (such as cutting externally and internally)

22)	Explain how to cut external threads using hand dies, and the method of fixing and adjusting the dies to give the correct thread fit

23)	Explain how to determine the drill size for tapped holes, and the importance of using the taps in the correct sequence

24)	Explain how to prepare drilling machines for operations (such as adjustment of table height and position; mounting and securing drills, reamers, countersink and counterbore tools in chucks or morse taper sockets; setting and adjusting spindle speeds; setting and adjusting guards/safety devices)

Unit 205 - Producing components using hand fitting techniques

25)	Explain how to mount the workpiece (such as in a machine vice, clamped to table, clamped to angle brackets); techniques of positioning drills to marking out, use of centre drills and taking trial cuts and checking accuracy, and how to correct holes which are off centre
26)	Explain how to produce a sliding or mating fit using filing, scraping and lapping techniques
27)	Describe the problems that can occur with the hand fitting activities, and how these can be overcome (such as defects caused by incorrectly ground drills, inappropriate speeds, damage by work holding devices)

28)	Explain when to act on their own initiative and when to seek help and advice from others
29)	Describe the importance of leaving the work area in a safe and clean condition on completion of the fitting activities (such as removing and storing power leads, isolating machines, removing and returning drills, cleaning the equipment and removing and disposing of waste)

Candidate has met criteria, see declaration page 4